

WE CLAIM:

1. A reaction product of reactants, wherein the reactants comprise:
 - a) a polyisocyanate;
 - b) a hydroxyalkyl carbamate;
 - 5 c) an aldehyde; and
 - d) at least one monohydric alcohol.
2. The reaction product of claim 1, wherein the polyisocyanate a) is an isocyanurate derived from hexamethylene diisocyanate or from isophorone diisocyanate.
- 10 3. The reaction product of claim 1, wherein the hydroxyalkyl carbamate is selected from at least one of hydroxypropyl carbamate and hydroxyethyl carbamate.
- 15 4. The reaction product of claim 1, wherein the aldehyde is formaldehyde.
5. The reaction product of claim 1, wherein the monohydric alcohol is selected from at least one of methanol, ethanol, n-propanol, isopropanol, n-butanol, isobutanol, and cyclohexanol.
- 20 6. A curable composition comprising:
 - a) the reaction product of claim 1; and
 - 25 b) at least one polymer having functional groups that are reactive with the reaction product of a).
7. The curable composition of claim 6, wherein the reaction product is present in an amount of 1 to 99 percent by weight based on the 30 total weight of resin solids in the curable composition.

8. The curable composition of claim 6, wherein the polymer is present in an amount of 1 to 99 percent by weight based on the total weight of resin solids in the curable composition.

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9. The curable composition of claim 6, wherein the polymer has functional groups selected from the group consisting of hydroxyl, carboxylic acid, amide, thiol, urea, carbamate, thiocarbamate, and mixtures thereof.

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10. The curable composition of claim 9, wherein the polymer is selected from the group consisting of acrylic, polyester, polyether and polyurethane polymers including mixtures thereof.

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11. A curable composition comprising:

a) the reaction product of claim 1, present as a crosslinking agent in an amount of 1 to 99 percent by weight based on the total weight of resin solids in the curable composition; and
b) a polymer having functional groups that are reactive with the crosslinking agent present in an amount of 1 to 99 percent by weight based
20 on the total weight of resin solids in the curable composition.

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12. The curable composition of claim 11, further comprising an auxiliary crosslinking agent, present in amounts of 1 to 50 percent by weight based on total weight of resin solids in the curable composition.

13. The curable composition of claim 12, wherein the auxiliary crosslinking agent is a polyisocyanate.

14. The curable composition of claim 13, wherein the auxiliary crosslinking agent is a polyisocyanate, wherein at least a portion of the isocyanate groups are capped.
- 5 15. The curable composition of claim 12, wherein the auxiliary crosslinking agent is an aminoplast.
- 10 16. The curable composition of claim 11, wherein the polymer of (b) is an acrylic polymer.
- 15 17. The curable composition of claim 11, wherein the crosslinking agent of a) is present in an amount of 1 to 50 percent by weight based on the total weight of resin solids in the curable composition.
- 20 18. The curable composition of claim 15, wherein the auxiliary aminoplast crosslinking agent is present in an amount of 1 to 35 percent by weight based on the total weight of resin solids in the curable composition.
- 25 19. The curable composition of claim 16, wherein the acrylic polymer is present in an amount of 20 to 85 percent by weight based on the total weight of resin solids in the curable composition.
- 20 20. The curable composition of claim 16, wherein the acrylic polymer has hydroxyl functional groups.
- 25 21. The curable composition of claim 20, wherein the acrylic polymer contains beta hydroxy ester groups.
- 30 22. The curable composition of claim 21, wherein the acrylic polymer is prepared from the following ingredients:

- 1) 1 to 70 percent by weight of an ethylenically unsaturated, beta-hydroxy ester functional monomer;
- 2) 5 to 50 percent by weight, based on the total solid weight of monomers used to prepare the polymer, of an ethylenically unsaturated, 5 hydroxyalkyl functional monomer different from the beta-hydroxy ester functional monomer of 1);
- 3) 0 to 40 percent by weight, based on the total solid weight of monomers used to prepare the polymer, of a vinyl aromatic monomer;
- 4) 0 to 60 percent by weight, based on the total solid weight of 10 monomers used to prepare the polymer, of at least one alkyl ester of acrylic acid or methacrylic acid; and
- 5) 0 to 20 percent by weight, based on the total solid weight of monomers used to prepare the polymer, of at least one ethylenically unsaturated monomer different from 1), 2), 3), and 4) above.

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23. The curable composition of claim 22, wherein the ethylenically unsaturated, beta-hydroxy ester functional monomer is selected from the group consisting of:
 - a) a reaction product of an ethylenically unsaturated, epoxy functional monomer and a saturated carboxylic acid having 1 to 20 carbon atoms; and
 - b) a reaction product of an ethylenically unsaturated acid functional monomer and an epoxy compound containing at least 4 carbon atoms which is not polymerizable with the ethylenically unsaturated acid functional monomer.

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24. The curable composition of claim 22 in which 4) comprises up to 30 percent by weight based on total solid weight of monomers, of an alkyl ester of acrylic or methacrylic acid having 4 to 18 carbon atoms.

25. The curable composition of claim 23, wherein the ethylenically unsaturated, beta-hydroxy ester functional monomer is derived from an ethylenically unsaturated, epoxy functional monomer and a saturated carboxylic acid having 13 to 20 carbon atoms.

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26. The curable composition of claim 25, wherein the ethylenically unsaturated, beta-hydroxy ester functional monomer is derived from glycidyl methacrylate and isostearic acid.

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27. The curable composition of claim 23, wherein the ethylenically unsaturated, beta-hydroxy ester functional monomer is derived from an ethylenically unsaturated acid functional monomer and an epoxy compound containing at least 4 carbon atoms which is not polymerizable with the ethylenically unsaturated acid functional monomer.

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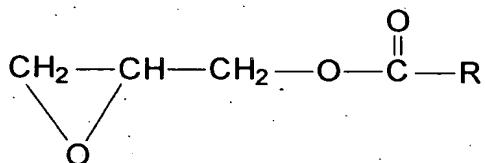
28. The curable composition of claim 23, wherein the ethylenically unsaturated, beta-hydroxy ester functional monomer is present in the polymer in an amount of about 20 to about 55 percent by weight, based on the total solid weight of monomers used to prepare the polymer.

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29. The curable composition of claim 27, wherein the ethylenically unsaturated, acid functional monomer is selected from the group consisting of acrylic acid, methacrylic acid, methacrylic anhydride, itaconic acid, and mixtures thereof.

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30. The curable composition of claim 27, wherein the epoxy compound has the following structure



wherein R is a hydrocarbon radical containing from 4 to 26 carbon atoms.

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31. The curable composition of claim 30, wherein R is a tertiary aliphatic group of 8 to 10 carbon atoms.

32. The curable composition of claim 22, wherein the ethylenically unsaturated, hydroxyalkyl functional monomer of 2) is selected from the group consisting of hydroxyethyl acrylate, hydroxyethyl methacrylate, hydroxypropyl acrylate, hydroxypropyl methacrylate, 4-hydroxybutyl acrylate, 4-hydroxybutyl methacrylate, adducts of caprolactone and hydroxyalkyl acrylates and methacrylates and mixtures thereof.

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33. The curable composition of claim 32, wherein the ethylenically unsaturated, hydroxyalkyl functional monomer is hydroxyethyl methacrylate, present in an amount of about 10 to about 30 percent by weight, based on the total solid weight of monomers used to prepare the polymer.

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34. The curable composition of claim 24, wherein component 4) is selected from the group consisting of n-butyl acrylate, t-butyl acrylate, 2-ethylhexyl acrylate, isobornyl acrylate, cyclohexyl acrylate, t-butyl cyclohexyl acrylate, trimethyl cyclohexyl acrylate, lauryl acrylate, n-butyl methacrylate, t-butyl methacrylate, 2-ethylhexyl methacrylate, isobornyl methacrylate, cyclohexyl methacrylate, t-butyl cyclohexyl methacrylate, trimethyl cyclohexyl methacrylate, lauryl methacrylate, and mixtures thereof.

35. The curable composition of claim 22, wherein the acrylic polymer contains carbamate functionality.

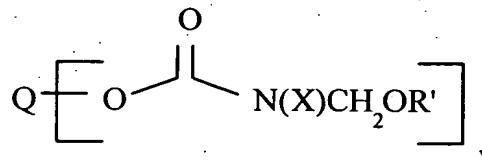
36. The curable composition of claim 22, wherein the vinyl aromatic monomer is present in the acrylic polymer in an amount of about 15 to about 5 35 percent by weight, based on the total solid weight of monomers used to prepare the polymer.

37. The curable composition of claim 11, further comprising an 10 additional polyol polymer different from the polymer b), selected from acrylic polymers, polyester polymers, polyurethane polymers, and mixtures thereof.

38 The curable composition of claim 37, wherein the additional polyol polymer is present in an amount of up to 30 percent by weight based 15 on the total weight of resin solids in the curable composition.

39. The curable composition of claim 38, wherein the additional polyol polymer is a polyester polymer.

20 40. A composition of matter comprising the structure:



wherein Q is a multi-valent organic moiety containing urethane linkages; X is H, -CH₂OH, or -CH₂OR'; R' is an alkyl or aryl group having from 1 to 12 carbon atoms; and y is at least 2.

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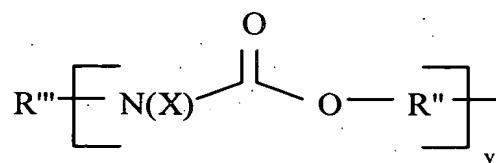
41. The composition of claim 40, wherein Q contains at least 2 urethane linkages.

42. The composition of claim 40, wherein Q contains cyclic moieties.

43. The composition of claim 42, wherein Q contains isocyanurate functionality.

44. The composition of claim 40, wherein Q contains groups of the structure $-\text{N}-\text{CH}_2-\text{OR}'$.

10 45. The composition of claim 40, wherein Q has the structure:



wherein R'' is a divalent group and R''' is a residue of a polyisocyanate.

15 46. The composition of claim 45, wherein R''' is a residue of an isocyanurate.

47. A curable composition comprising:
a) the composition of matter of claim 40; and
b) at least one polymer having functional groups that are reactive
20 with the composition of matter a).

48. The curable composition of claim 47, wherein the composition of matter a) is present in an amount of 1 to 99 percent by weight based on the total weight of resin solids in the curable composition.

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49. The curable composition of claim 47, wherein the polymer is present in an amount of 1 to 99 percent by weight based on the total weight of resin solids in the curable composition.

50. The curable composition of claim 47, wherein the polymer has functional groups selected from the group consisting of hydroxyl, carboxylic acid, amide, thiol, urea, carbamate, thiocarbamate, and mixtures thereof.

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51. The curable composition of claim 50, wherein the polymer is selected from the group consisting of acrylic, polyester, polyether and polyurethane polymers including mixtures thereof.

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52. A curable composition comprising:

a) the composition of matter of claim 40, present as a crosslinking agent in an amount of 1 to 99 percent by weight based on the total weight of resin solids in the curable composition; and

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b) a polymer having functional groups that are reactive with the crosslinking agent a) present in an amount of 1 to 99 percent by weight based on the total weight of resin solids in the curable composition.

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53. The curable composition of claim 52, further comprising an auxiliary crosslinking agent, present in amounts of 1 to 50 percent by weight based on total weight of resin solids in the curable composition.

54. The curable composition of claim 53, wherein the auxiliary crosslinking agent is a polyisocyanate.

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55. The curable composition of claim 54, wherein the auxiliary crosslinking agent is a polyisocyanate, wherein at least a portion of the isocyanate groups are capped.

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56. The curable composition of claim 53, wherein the auxiliary crosslinking agent is an aminoplast.

57. The curable composition of claim 52, wherein the polymer of (b) is an acrylic polymer.

5 58. The curable composition of claim 52, wherein the crosslinking agent of a) is present in an amount of 1 to 50 percent by weight based on the total weight of resin solids in the curable composition.

10 59. The curable composition of claim 56, wherein the auxiliary aminoplast crosslinking agent is present in an amount of 1 to 35 percent by weight based on the total weight of resin solids in the curable composition.

15 60. The curable composition of claim 57, wherein the acrylic polymer is present in an amount of 20 to 85 percent by weight based on the total weight of resin solids in the curable composition.

61. The curable composition of claim 57, wherein the acrylic polymer has hydroxyl functional groups.

20 62. The curable composition of claim 61, wherein the acrylic polymer contains beta hydroxy ester groups.

63. The curable composition of claim 62, wherein the acrylic polymer is prepared from the following ingredients:

25 1) 1 to 70 percent by weight of an ethylenically unsaturated, beta-hydroxy ester functional monomer;

2) 5 to 50 percent by weight, based on the total solid weight of monomers used to prepare the polymer, of an ethylenically unsaturated, hydroxylalkyl functional monomer different from the beta-hydroxy ester

30 functional monomer of 1);

- 3) 0 to 40 percent by weight, based on the total solid weight of monomers used to prepare the polymer, of a vinyl aromatic monomer;
- 4) 0 to 60 percent by weight, based on the total solid weight of monomers used to prepare the polymer, of at least one alkyl ester of acrylic acid or methacrylic acid; and
- 5) 0 to 20 percent by weight, based on the total solid weight of monomers used to prepare the polymer, of at least one ethylenically unsaturated monomer different from 1), 2), 3), and 4) above.

10. 64. The curable composition of claim 63, wherein the ethylenically unsaturated, beta-hydroxy ester functional monomer is selected from the group consisting of:

- a) a reaction product of an ethylenically unsaturated, epoxy functional monomer and a saturated carboxylic acid having 1 to 20 carbon atoms; and
- b) a reaction product of an ethylenically unsaturated acid functional monomer and an epoxy compound containing at least 4 carbon atoms which is not polymerizable with the ethylenically unsaturated acid functional monomer.

20. 65. The curable composition of claim 63 in which 4) comprises up to 30 percent by weight based on total solid weight of monomers, of an alkyl ester of acrylic or methacrylic acid having 4 to 18 carbon atoms.

25. 66. The curable composition of claim 64, wherein the ethylenically unsaturated, beta-hydroxy ester functional monomer is derived from an ethylenically unsaturated, epoxy functional monomer and a saturated carboxylic acid having 13 to 20 carbon atoms.

67. The curable composition of claim 66, wherein the ethylenically unsaturated, beta-hydroxy ester functional monomer is derived from glycidyl methacrylate and isostearic acid.

5 68. The curable composition of claim 64, wherein the ethylenically unsaturated, beta-hydroxy ester functional monomer is derived from an ethylenically unsaturated acid functional monomer and an epoxy compound containing at least 4 carbon atoms which is not polymerizable with the ethylenically unsaturated acid functional monomer.

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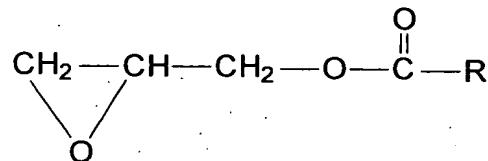
69. The curable composition of claim 64, wherein the ethylenically unsaturated, beta-hydroxy ester functional monomer is present in the polymer in an amount of about 20 to about 55 percent by weight, based on the total solid weight of monomers used to prepare the polymer.

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70. The curable composition of claim 68, wherein the ethylenically unsaturated, acid functional monomer is selected from the group consisting of acrylic acid, methacrylic acid, methacrylic anhydride, itaconic acid, and mixtures thereof.

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71. The curable composition of claim 68, wherein the epoxy compound has the following structure



wherein R is a hydrocarbon radical containing from 4 to 26 carbon atoms.

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72. The curable composition of claim 71, wherein R is a tertiary aliphatic group of 8 to 10 carbon atoms.

73. The curable composition of claim 63, wherein the ethylenically unsaturated, hydroxyalkyl functional monomer of 2) is selected from the group consisting of hydroxyethyl acrylate, hydroxyethyl methacrylate, hydroxypropyl acrylate, hydroxypropyl methacrylate, 4-hydroxybutyl acrylate, 4-hydroxybutyl 5 methacrylate, adducts of caprolactone and hydroxyalkyl acrylates and methacrylates and mixtures thereof.

74. The curable composition of claim 73, wherein the ethylenically unsaturated, hydroxyalkyl functional monomer is hydroxyethyl methacrylate, 10 present in an amount of about 10 to about 30 percent by weight, based on the total solid weight of monomers used to prepare the polymer.

75. The curable composition of claim 65, wherein component 4) is selected from the group consisting of n-butyl acrylate, t-butyl acrylate, 2- 15 ethylhexyl acrylate, isobornyl acrylate, cyclohexyl acrylate, t-butyl cyclohexyl acrylate, trimethyl cyclohexyl acrylate, lauryl acrylate, n-butyl methacrylate, t- butyl methacrylate, 2-ethylhexyl methacrylate, isobornyl methacrylate, cyclohexyl methacrylate, t-butyl cyclohexyl methacrylate, trimethyl cyclohexyl methacrylate, lauryl methacrylate, and mixtures thereof.

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76. The curable composition of claim 63, wherein the acrylic polymer contains carbamate functionality.

77. The curable composition of claim 63, wherein the vinyl aromatic 25 monomer is present in the acrylic polymer in an amount of about 15 to about 35 percent by weight, based on the total solid weight of monomers used to prepare the polymer.

78. The curable composition of claim 52, further comprising an additional polyol polymer different from the polymer b), selected from acrylic polymers, polyester polymers, polyurethane polymers, and mixtures thereof.

5 79. The curable composition of claim 78, wherein the additional polyol polymer is present in an amount of up to 30 percent by weight based on the total weight of resin solids in the curable composition.

80. The curable composition of claim 79, wherein the additional
10 polyol polymer is a polyester polymer.